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OF GENERAL ELECTRIC CO.

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Street Series MAZDA Lamps

100 Candle-Power Street Series MAZDA Lamp
One-Half Scale

Street Series MAZDA Lamps

THE principal distinction between street series MAZDA lamps and multiple MAZDA lamps is that multiple lamps are designed for operation on circuits regulated for voltage, whereas street series lamps are designed for operation on circuits regulated for current. For this reason, the filaments of all sizes of street series lamps are made as accurately as possible to a given current rating. The unavoidable variations of manufacture are made to appear as variations in the voltage in so far as practical in order to maintain constancy of current rating. The various sizes are rated in candle-power rather than in wattage, and improvements in efficiency appear, therefore, as decreases in wattage and voltage. This candle-power rating must of necessity be an average rating, for, while the candle-power of all lamps must lie within close limits, individual lamps are almost never of the exact rated candle-power. Those making street-lighting specifications should appreciate the fact that current regulation, instrument calibration, line leaks, and, most of all, variations in initial candle-power incident to manufacture, cause the lamps which, at normal current, average the rated candle-power to vary therefrom in either direction.

Of series lamps designed for a given current rating, those of the higher candle-powers in general produce light the more efficiently. This is due to the fact that increasing the length of the filament does not increase the loss of energy a proportionate amount. Also, for a given candle-power and life, high candle-power lamps can be made more efficient by employing short, stocky filaments designed for high current even though the losses through the supports are increased. This is due primarily to the fact that at a given temperature the cross-sectional area of a small filament is reduced by evaporation proportionately more rapidly than is that of a large one, and, for a given life, the larger filament can therefore be operated at a higher temperature. Alternating-current series circuits have become fairly definitely standardized at 6.6 amperes, and on such circuits, and on other circuits ranging from 4 to 10 amperes, in order to take advantage of the higher efficiency of lamps of higher current ratings, it is necessary to make use of transformers or auto-transformers to step up the line current to

the current required by the lamps. The introduction of auxiliary apparatus into a circuit results, of course, in increased investment and new energy losses, and, as a rule, in a decreased operating power-factor. Low candle-power lamps are, for these reasons, designed for operation at line current. Lamps designed to give 400 candle-power or more at 15 or 20 amperes can usually be operated through transformers with economy. Whether straight series lamps or high-current lamps should be selected is a problem which depends upon individual circuit conditions and to which no general rule can be applied except that the higher the candle-power of the lamp the more likely that an advantage may be realized by employing transformer units. The factors which influence the selection are fully discussed in Bulletin 25, Street Series Alternating-Current Incandescent Lamp Circuits.

Street series lamps are best operated in a circuit which contains a device designed to maintain the lamp current at a constant value regardless of what proportion of the lamps are being operated. In other words, the value of current is determined by auxiliary apparatus and is only indirectly dependent upon the characteristics of the lamps. Care should be exercised to see that the adjustment of the current-regulating apparatus is such that the normal current corresponds to the rating of the lamps. Burning lamps below their current rating results in poor efficiency and decreased candle-power; burning above increases the candle-power, but increases the wattage and shortens their hours of service. In the curves of Fig. 1 are given the values of candle-power, lumens per watt, and volts for values of current ranging from 10 per cent below to 10 per cent above normal.

The life of MAZDA street series lamps is rated at 1350 hours. In practice, on well regulated circuits, this rating has been found to be conservative and is often exceeded. Being of comparatively low wattage, and operating at low voltages, street series lamps were from the first particularly adaptable to the gas-filled construction. The low wattage prevented excessive heating while the low voltage prevented arcking—factors which presented difficulties in the design of the first multiple lamps of this construction.

MAZDA street series lamps give an almost uniform intensity throughout life. This is due to the fact that although the luminous area of the filament is constantly being decreased, and the bulb slightly discolored, by the evaporation of the filament, the current

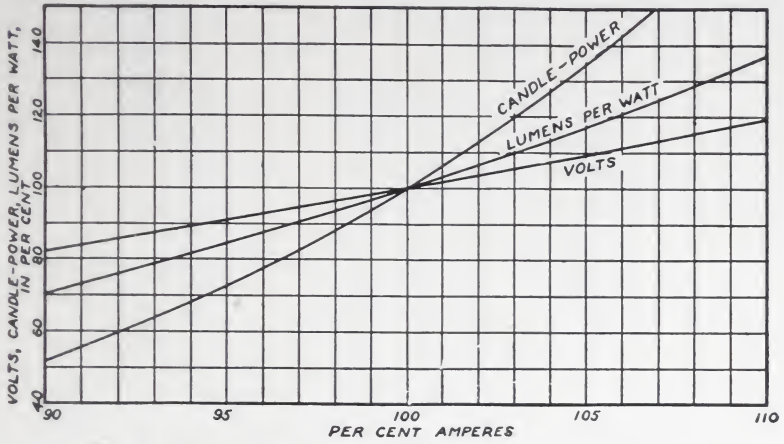

Fig 1—Characteristic Curves of MAZDA Street Series Lamps

remains at its initial value and the increased brilliancy per unit of surface, due to the higher current density, maintains the intensity very close to its initial value. Through the action of the gas, bulb blackening is minimized and that which does form is, due to the evaporated tungsten being carried upward by the heated gas, located well up in the bulb where it cannot interfere to any serious extent with the utilization of the light.

Application of the new construction to street series lamps has resulted in an increased efficiency of light production of from 20 to 50 per cent, depending upon the candle-power. It has also made practical the manufacture of units giving 1000 candle-power and higher. Lamps are regularly supplied at the current ratings and candle-powers given in Table 1. All lamps of a given current rating may be operated on the same circuit; this makes possible the use of low candle-power lamps along streets comparatively free from traffic, with larger units at street intersections.

The coiled filament, besides making practical the development of the gas-filled lamps, has, through its concentration, rendered possible the design of accessories which control the light of incandescent lamps to an extent never before approached. In fact, the development of the Holophane prismatic refractor, a device which employs the light-controlling principle of the prism to distribute the light in a definite, predetermined manner, has probably almost as important a bearing on street lighting as the development of the gas-filled lamp itself. The position of the filament within the

Street Series MAZDA Lamps

Fig. 2—400 Candle-Power
5.5 and 6.6 Ampere MAZDA Lamp
(One-Fourth Scale)

Fig. 3—600 Candle-Power
20 Ampere MAZDA Lamp
(One-Fourth Scale)

Table No. 1

MAZDA Street Series Lamps

Amperes	Candle-Power	Average Volts	Efficiency, Lumens per Watt	Type and Size of Bulb	Diameter in Inches	Maximum Over All Length in Inches	Base Regularly Supplied	Standard Package Quantity
5.5	60	8.5	12.83	S-24½	3 1/16	7¼	Mogul Screw	50
	80	10.8	13.52	S-24½	3 1/16	7¼	Mogul Screw	50
	100	13.1	13.97	S-24½	3 1/16	7¼	Mogul Screw	50
	250	30.9	15.33	PS-35	4⅜	9¾	Mogul Screw	24
	400	49.5	15.33	PS-40	5	10	Mogul Screw	12
6.6	60	7.1	12.70	S-24½	3 1/16	7¼	Mogul Screw	50
	80	9.9	13.27	S-24½	3 1/16	7¼	Mogul Screw	50
	100	10.8	13.97	S-24½	3 1/16	7¼	Mogul Screw	50
	250	24.6	16.12	PS-35	4⅜	9¾	Mogul Screw	24
	400	38.8	16.32	PS-40	5	10	Mogul Screw	12
	600	58.2	16.32	PS-40	5	10	Mogul Screw	12
7.5	60	6.2	12.57	S-24½	3 1/16	7¼	Mogul Screw	50
	80	7.9	13.37	S-24½	3 1/16	7¼	Mogul Screw	50
	100	9.5	13.97	S-24½	3 1/16	7¼	Mogul Screw	50
	250	21.0	16.99	PS-35	4⅜	9¾	Mogul Screw	24
	400	33.1	17.46	PS-40	5	10	Mogul Screw	12
	600	49.6	17.46	PS-40	5	10	Mogul Screw	12
15.0	400	13.3	20.27	PS-40	5	12½	Mog. Sc. Sk.	12
20.0	600	14.1	21.31	PS-40	5	12½	Mog. Sc. Sk.	12
	1000	22.5	22.45	PS-40	5	12½	Mog. Sc. Sk.	12

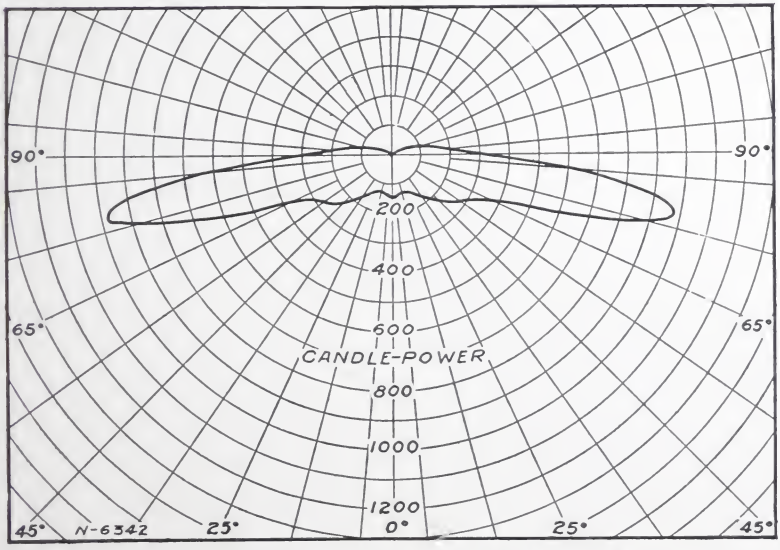

Fig. 4—Typical Refractor Unit and Distribution Obtained with 400 Candle-Power MAZDA Lamp

advantage of when lamps are renewed, and do not necessitate the scrapping of equipment in service.

It should not be inferred that because of the high efficiency of MAZDA street series lamps the expense to which a city is put for street lighting should necessarily show a reduction. The largest part of the expense of operating lamps is that due to investment in apparatus, poles, lines, etc., and such investment is not reduced by the use of more efficient units. In the majority of cases, conditions are such that both the city and the central station benefit the most by taking advantage of the higher efficiency to increase the volume of light either by replacing units with others of a higher candle-power or by decreasing the gaps between units at present in service.

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7B	Data on Illumination
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15A	Engineering Features of Electric Sign Lighting.
15B	Lighting of Billboards and Large Painted Signs.
18A	MAZDA Street Railway Lamps.
20	Industrial Lighting (With Supplement).
21	The Successful Handling of the Small Consumer in Europe.
22	Show Case Lighting.
23	MAZDA Lamps for Projection Purposes.
24	Outdoor Tennis Court Lighting.
25	Street Series Alternating-Current Incandescent Lamp Circuits.
26	The MAZDA Lamp in Photography.
27	A Civic Duty for Engineers.

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